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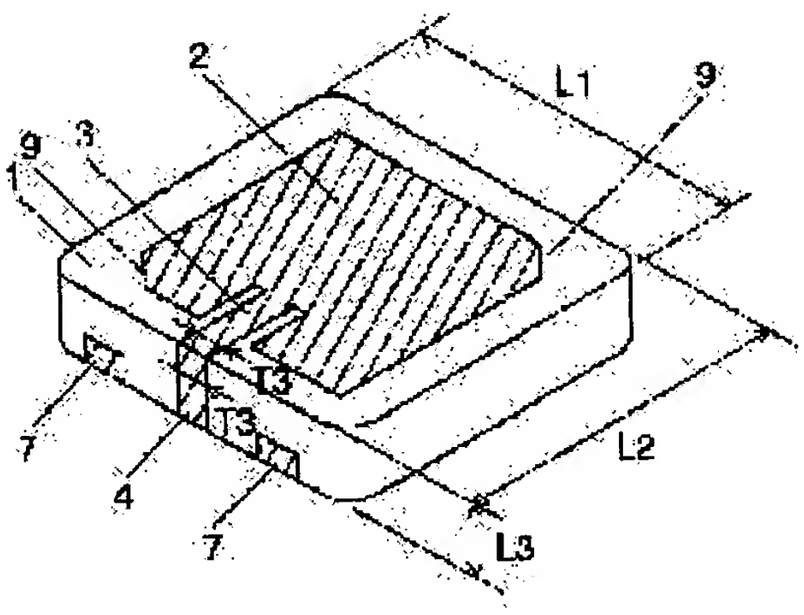
(54) ANTENNA AND ANTENNA SYSTEM AND ELECTRONIC DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an antenna with a small size, a high gain and high reliability that is capable of surface mount.
SOLUTION: A radiation electrode 2 is mounted on one major side of a board 1, an earth electrode 6 is mounted on the other major side of the board 1 opposed to the major side, a fixing electrode 7 is mounted on the side face of the board, and a feeding strip electrode is mounted on the side face and both the major sides of the board, which is electrically connected to the radiation electrode 2, not is contact with the earth electrode 6, has an inductive component and a capacitive component between the radiation electrode 2 and the earth electrode 6 and acts like a matching circuit.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The antenna characterized by both having a capacitance component in the aforementioned electric supply means, between the aforementioned radiation electrodes and the aforementioned electric supply means, and each aforementioned ground inter-electrode as it is characterized by providing the following Substrate The radiation electrode countered and prepared in one principal plane of the aforementioned substrate The ground electrode countered and prepared in the principal plane of another side of the aforementioned substrate It has an electric supply means by which the aforementioned ground electrode was prepared in non-contact while connecting with the aforementioned radiation electrode electrically and being prepared at least for the both sides of aforementioned one principal plane and the side of the aforementioned substrate moreover, and the aforementioned electric supply means is an inductance component.
[Claim 2] The antenna according to claim 1 characterized by having the portion which the aforementioned electric supply means and the aforementioned radiation electrode counter through the aforementioned slit by preparing a slit in the both sides of the aforementioned electric supply means in the electric supply means on one principal plane of a substrate.
[Claim 3] An electric supply means is an antenna a claim 1 and given [any 1] in two characterized by having with the 1st feeder formed in the principal plane in which the radiation electrode of a substrate was formed, the 2nd feeder formed on the side which adjoined the aforementioned principal plane, and the electric supply section prepared in the aforementioned principal plane and the principal plane of an opposite side.
[Claim 4] An antenna the claim 1 characterized by aiming at transmission and reception of the electric wave which consists an electric supply means of a circularly-polarized wave of two or more preparations - given [any 1] in three.
[Claim 5] Specific-inductive-capacity epsilonr of a substrate is an antenna the claim 1 characterized by or more 4 being 150 or less - given [any 1] in four.
[Claim 6] An antenna the claim 1 characterized by setting surface roughness of a substrate to 50 micrometers or less - given [any 1] in five.
[Claim 7] An antenna the claim 1 characterized by making sintered density into 92% or more while constituting a substrate from a ceramic - given [any 1] in six.
[Claim 8] An antenna the claim 1 characterized by a dielectric dissipation factor constituting a substrate from 0.005 or less resin - given [any 1] in seven.
[Claim 9] An antenna the claim 1 characterized by giving at least one side of beveling processing or taper processing to the corner of a substrate - given [any 1] in eight.
[Claim 10] The antenna according to claim 9 characterized by setting R of C beveling to 0.1mm or more while adopting C beveling processing as beveling processing.
[Claim 11] The antenna according to claim 1 to 10 characterized by for resistivity making an electrode material the metallic material below 1x10-4ohmcm, and setting electrode thickness to 0.01 micrometers - 50 micrometers.
[Claim 12] The antenna characterized by considering as composition equipped with the coaxial cable which joins a low noise amplifier substrate and performs transfer of the current supply to the aforementioned low noise amplifier substrate, and an I/O signal to the rear-face side of the ground electrode of the aforementioned antenna which it comes to indicate to claims 1-11, and the aforementioned antenna.
[Claim 13] The radio receiving set which is equipment which receives a satellite or the data sent by radio from a terrestrial base station, and is characterized by having a means to restore to the input signal which received with an antenna and the aforementioned antenna a claim 1 - given [any 1] in 12, and to generate a data signal, and a means to output the aforementioned data signal as voice or an image.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the antenna, antenna equipment, and electronic equipment using the micro stripe used as an antenna for navigation, such as mobile communications, such as wireless data transmission and satellite communication, and GPS.
[0002]
[Description of the Prior Art] In recent years, the micro-stripe antenna used as an antenna for the navigation 2.4GHz band wireless LAN, for [DAB and GPS] satellites, etc. came to be used widely. the line of the former [it / antenna / this] -- it is because it contributed to the miniaturization of a device, and thin shape-ization greatly since small and thin-shape-izing were possible compared with an antenna However, as shown in JP,5-199032,A, as for the conventional micro-stripe antenna, it was common to have used the electric supply pin of the shape of a rivet which consists of a metallic conductor as an electric supply means to a radiation electrode.
[0003]
[Problem(s) to be Solved by the Invention] With the micro-stripe antenna which supplies electric power by such electric-supply pin, automatic mounting was difficult, and since the electric-supply pin had projected to the substrate exterior, when there were troubles, -- consideration special at the time of transportation is needed, and it is hard to deal with it --, since the restrictions which come from impedance matching were, it was surely very difficult in the thing of a substrate it prepares in a center section mostly, and a colander is not obtained but connection with an external circuit prepares the electric-supply section for an electric-supply pin in
[0004] Moreover, although the laminating antenna is also proposed as an object for surface mounting, since this laminating antenna is calcinated where an electrode is pinched between ceramic substrates, its baking conditions are very severe and an incidence rate with a poor process is very high [an antenna / a production facility is excessive and a manufacturing cost is high, and]. Furthermore, there was a trouble which adjustment of a property when it calcinates and the property of the done antenna has shifted from criteria says is very difficult.
[0005] this invention solves the above-mentioned conventional technical problem, does not have an electric supply pin, and automatic mounting is possible, and manufacture is easy, and the yield is high, and it aims at offering an antenna with still easier property adjustment, antenna equipment, and electronic equipment.
[0006]
[Means for Solving the Problem] The radiation electrode which this invention countered one principal plane of a substrate and a substrate, and was prepared, It connects with the ground electrode countered and prepared in the principal plane of another side of a substrate, and a radiation electrode electrically. And while being prepared for the both sides of one [at least] principal plane and the side of a substrate, and a ground electrode is equipped with the electric supply means prepared in non-contact and an electric supply means has an inductance component It considered as the composition which has a capacitance component in an electric supply means, between radiation electrodes and an electric supply means, and each ground inter-electrode.
[0007]
[Embodiments of the Invention] The radiation electrode which invention according to claim 1 countered one principal plane of a substrate and the aforementioned substrate, and was prepared, It connects with the ground electrode countered and prepared in the principal plane of another side of the aforementioned substrate, and the aforementioned radiation electrode electrically. And while being prepared at least for the both sides of aforementioned one principal plane and the side of the aforementioned substrate, and the aforementioned ground electrode is equipped with the electric supply means prepared in non-contact and the aforementioned electric supply means has an inductance component By having a capacitance component in the aforementioned electric supply means, between the

aforementioned radiation electrodes and the aforementioned electric supply means, and each aforementioned ground inter-electrode, there is no electric supply pin, automatic mounting is possible, and manufacture is easy, the yield is high and it becomes still easier to property adjust it.
[0008] In the electric supply [set invention according to claim 2 to a claim 1, and] means on one principal plane of a substrate By preparing a slit in the both sides of the aforementioned electric supply means, through the aforementioned slit, by having the portion which the aforementioned electric supply means and the aforementioned radiation electrode counter the 1st of an effect By lengthening the length of an electric supply means in efficiency, it is being able to take the own large inductance component of an electric supply means. It can prevent that make an electric supply means thin too much by this in order to earn a part for an inductance, and loss increases. The 2nd of an effect is being able to adjust an electric supply means and a radiation inter-electrode joint capacity. What is necessary is to extend slit width to make joint capacity small, and just to narrow eight slits to enlarge. The 3rd is being able to make it easier to lower the frequency of operation of an antenna and to miniaturize.
[0009] In claims 1 and 2, by having an electric supply means with the 1st feeder formed in the principal plane in which the radiation electrode of a substrate was formed, the 2nd feeder formed on the side which adjoined the aforementioned principal plane, and the electric supply section prepared in the aforementioned principal plane and the principal plane of an opposite side, surface mounting becomes easy and, moreover, invention according to claim 3 can suppress dispersion in a property.
[0010] Invention according to claim 4 can offer the flat antenna which can transmit and receive the electric wave which consists an electric supply means of a circularly-polarized wave of two or more preparations and in which small automatic mounting is possible in claims 1-3.
[0011] In claims 1-4, by having set surface roughness of a substrate to 50 micrometers or less, invention according to claim 5 can prevent the fall of Q value, and can raise the gain of an antenna.
[0012] In claims 1 and 5, when specific-inductive-capacity epsilonr of a substrate carries out to 150 or less [4 or more], invention according to claim 6 can promote the miniaturization of an antenna, can make the band of resonance frequency large, and can suppress dispersion in a property further.
[0013] while invention according to claim 7 can raise a mechanical strength by having made sintered density into 92% or more in claims 1-6 while constituting the substrate from a ceramic, the property which was good as for processability etc. and was further stabilized can be acquired -- the fall of Q value and decline in specific inductive capacity can both be prevented
[0014] invention according to claim 8 can acquire the property which attained lightweight-ization, was good as for processability etc. and was further stabilized in claims 1-7, maintaining a mechanical strength, when the dielectric dissipation factor constituted the substrate from 0.005 or less resin -- the fall of Q value and decline in specific inductive capacity can both be prevented
[0015] In claims 1-8, since invention according to claim 9 can prevent the big chip of the corner of a board by giving at least one side of beveling processing or taper processing to the corner of a substrate, it is in the middle of use, the property of an antenna changes a lot, and fault does not produce it.
[0016] In a claim 9, certain moreover, invention according to claim 10 can produce an antenna with sufficient productivity by having set R of C beveling to 0.1mm or more while adopting C beveling processing as beveling processing.
[0017] in claims 1-10, resistivity makes an electrode material the metallic material below 1x10-4ohmcm, and invention according to claim 11 sets electrode thickness to 0.01 micrometers - 50 micrometers -- a fall and conductor of Q value -- a disadvantage increase can be prevented, it is low loss and the antenna of high interest profit can be obtained
[0018] Invention according to claim 12 joins a low noise amplifier substrate to the rear-face side of the ground electrode of an antenna and the aforementioned antenna in claims 1-10. By having considered as composition equipped with the coaxial cable which performs transfer of the current supply to the aforementioned low noise amplifier substrate, and an I/O signal, the aforementioned antenna can be held stably and an efficient transceiver property can be acquired. Moreover, the electric wave which an antenna transmits and receives is amplified efficiently, and an exchange of a digital disposal circuit and a signal can be performed certainly.
[0019] invention according to claim 13 -- a satellite -- or It is equipment which receives the data sent by radio from a terrestrial base station. An antenna a claim 1 - given [any 1] in 12, a means to restore to the input signal which received with the aforementioned antenna, and to generate a data signal, and the aforementioned data signal -- voice -- or While limitation of an arrangement place etc. decreasing and becoming easy to carry out the layout of equipment etc. by having a means to output as an image, data communication can be performed certainly. Moreover, since it has endurance with a very big antenna, the installation conditions of wireless LAN equipment become wide range. Furthermore, since an antenna does not project greatly outside, faults, such as breakage, do not arise.

[0020] Hereafter, the form of the thing operation in this invention is explained.
[0021] Drawing 1 , and 2 and 3 are the surface perspective diagram showing the antenna in the form of 1 operation of this invention, a rear-face perspective diagram, and a side elevation by the side of an electric supply means, respectively.
[0022] 1 is a substrate and a substrate 1 consists of dielectric materials in drawing 1 , and 2 and 3. As for specific-inductive-capacity epsilonr of a substrate 1, it is desirable that it is [or more 4] 150 (130 or less [Preferably / 18 or more]) or less. If specific-inductive-capacity epsilonr is larger than 150, if specific-inductive-capacity epsilonr of a substrate 1 is smaller than 4, a substrate 1 becomes large too much, an antenna cannot be miniaturized, and a resonance frequency band becomes narrow too much, and while a resonance frequency band separates and being able to acquire a predetermined property neither by the difference in little composition, nor generating of a chip etc., the fault that dispersion in a property becomes large will arise.
[0023] Moreover, there are few falls of specific-inductive-capacity epsilonr in or more 4 12 or less field of Q value, and 0.005 or less resin substrate is suitably used for a dielectric dissipation factor as a substrate 1, and 0.005 or less ceramic substrate is similarly used for a dielectric dissipation factor with few falls of Q value suitably as a substrate 1 in or more 6 150 or less field.
[0024] As a concrete component of a substrate 1, ceramic substrates, such as resin system substrates, such as glass/fluororesin, glass / heat-curing PPO resin, BT resin, a ceramic powder PTFE laminate, and a ceramic/whisker, a forsterite, an alumina system, a titanic-acid magnesium system and a titanic-acid calcium system, a zirconia tin titanium system, a barium-titanate system, and lead, a calcium titanium system, etc. are mentioned. It is desirable to use a ceramic when it takes into consideration that weatherability is good, and a mechanical strength is large and cheap also in these components. When using a ceramic as a component of a substrate, in order to enlarge anti-**** etc., 92% or more (preferably 95% or more) of sintered density is desirable. If sintered density is 92% or less, the fall of Q value and specific-inductive-capacity epsilonr may fall, and fault will arise.
[0025] Moreover, in order to suppress dispersion in the property in an interface with the electrode mentioned later, as for the surface roughness of a substrate 1, it is desirable to be referred to as 50 micrometers or less (especially preferably 10 micrometers or less, still more preferably 5 micrometers or less). if surface roughness is 50 micrometers or more -- the conductor of an electrode -- while making loss increase and causing the fall of an absolute gain of an antenna, it may become the dispersion factor of an effective dielectric constant, a gap of the resonance frequency of an antenna may be caused, and the antenna gain in desired frequency may fall
[0026] It can consider as a rectangular tabular as shows the configuration of a substrate 1 to drawing 1 , and 2 and 3, and a polygon tabular (a cross section a triangle, a square, a pentagon .....). When considering as a polygon tabular at this time, it is desirable for each side to be in abbreviation etc. by carrying out, and to consider as the shape of a polygon in respect of mounting nature or a property.
[0027] Moreover, although equalization of a property or stabilization of a property can be performed with the gestalt of this operation by making thickness of a substrate 1 uniform (the thickness of a center section and an edge being almost the same), you may change the thickness of a substrate 1 between predetermined portions according to an operating condition, the kind of used machine, etc. That is, for example, two or more crevices and level difference sections can be formed in a substrate 1, thickness of one edge of a substrate 1 can be made thicker than the thickness of the edge of an opposite side, or it can be made thin.
[0028] Furthermore, it can prevent that a big chip etc. occurs in corner 1c of a substrate 1, and a property changes to it by giving beveling, a taper, etc. to the corner of a substrate 1.
[0029] Therefore, most things changed to the corner of a substrate 1 when the chip on the way to corner 1c of a substrate 1 with big transmission and receiving property arises by giving beveling, the taper, etc. beforehand are lost as mentioned above.
[0030] When it takes into consideration that productivity and positive corner processing can be performed etc. at this time, it is desirable to perform C beveling or R processing. Even if a little shock etc. joins a substrate 1 by setting corner processing by C beveling at this time, and R processing to 0.1mm or more (preferably 0.2mm or more), most generating of the chip of the corner of a substrate 1 etc. is lost, and though such a big shock that a substrate 1 is missing etc. is added, it generates only merely few chips, but neither transmission nor a big change of a receiving property produces it. Although this substrate 1 needed beveling, taper processing, etc., especially when the ceramic which a chip tends [comparatively] to generate as mentioned above is used whatever the material which constitutes a substrate 1, they are effective. Furthermore, the big chip of a corner can be prevented as a form of other operations by preparing the resin of the organic system which performs chip prevention to the corner of a substrate 1 etc., without giving C beveling and taper processing to the corner of a substrate 1.
[0031] By performing such chip preventive measures, the poor process by generating of a chip can be suppressed and

the productivity and yield of an antenna can be raised.
[0032] Moreover, since a dimension can be made into the minimum while making the frequency of operation of an antenna the optimal by fulfilling the following conditions, when L1 (cm) and length are set to L2 (cm) and thickness is set to L3 (cm) for the width of face of an antenna, while being able to supply an antenna stably, gain and bandwidth are securable proper.
[0033]
0.7xlambda0/(2xepsilonr1/2) <=L1<=2.0xlambda0/ (2xepsilonr1/2)
0.7xlambda0/(2xepsilonr1/2) <=L2<=2.0xlambda0/ (2xepsilonr1/2)
0.08 <=L3 <=0.5 -- here, the specific inductive capacity of the component of the substrate 1 to which epsilonr uses the free space wave length (unit : cm) in the center frequency at the time of lambda 0 operating an antenna for an antenna is expressed If less than the above-mentioned range in thickness L3, while the mechanical strength of the antenna itself becoming low and becoming easy to generate a crack etc., the fall of gain and reduction of bandwidth will be caused and, as for transmission and reception of the stable electric wave, they will become impossible. Moreover, if it exceeds the above-mentioned range, an antenna configuration will become large too much and will spoil the merit of a miniaturization and thin-shape-izing.
[0034] In drawing 1 , and 2 and 3, 2 is the radiation electrode of the shape of a rectangle equipped with the **** separation element 9 for realizing the circularly-polarized wave prepared in one principal plane of a substrate 1.
[0035] 6 is the ground electrode which countered the radiation electrode 2 and was prepared in another principal plane of a substrate 1.
[0036] Moreover, an electric supply means is electrically joined to a radiation electrode at the side and both the principal planes of a substrate 1, and the ground electrode 6 is formed in non-contact.
[0037] It constitutes the capacitance component, respectively between the radiation electrode 2, between feeders 3 and the ground electrode 6, and a feeder 3 while the electric supply means consists of feeders 3 and 4 and the electric supply section 5, a feeder 3 is formed on the principal plane in which the radiation electrode 2 in a substrate 1 was formed, and it is carrying out the band form configuration and moreover has an inductance component by feeder 3 the very thing. Moreover, while the feeder 3 is preferably formed in the radiation electrode 2 and one, as moreover shown in the after-mentioned, the feeder 3 has the portion which has countered ends with the radiation electrode 2 through a slit 8. In addition, with the form of this operation, although the feeder 3 and the radiation electrode 2 were formed by one, a feeder 3 and the radiation electrode 2 may be isolated, it may prepare on the same principal plane of a substrate 1, and they may be electrically joined by conductive members, such as solder.
[0038] Furthermore, the feeder 4 has a capacitance component, respectively between the radiation electrode 2, between feeders 4 and the ground electrode 6, and a feeder 4, and constitutes a part of matching circuit respectively while it has the band form configuration established for forming on the principal plane of a substrate 1, and the side prepared in the abbreviation perpendicular and has an inductance component by feeder 4 the very thing too. It connects with the feeder 3 electrically and the feeder 4 really considered feeders 3 and 4 as composition with the form of this operation. However, the composition of having isolated and formed feeders 3 and 4 and having connected between them electrically by members, such as solder, as above-mentioned may be used.
[0039] Moreover, the electric supply section 5 is formed on the principal plane of the same substrate 1 as the ground electrode 6, and is connected to an external circuit. It connects with the feeder 4 electrically and a feeder 4 and the electric supply section 5 really considered the electric supply section 5 as composition with the form of this operation. However, the composition of having isolated and formed a feeder 4 and the electric supply section 5, and having connected between them electrically by members, such as solder, as above-mentioned may be used. Furthermore, the key objective of the electric supply section 5 is connecting an electric supply means and an external circuit electrically by being joined to an external circuit, when using a feeder 4 for connection with an external circuit, it becomes unnecessary and an electric supply means will consist of feeders 3 and 4 in this case. In addition, by forming the electric supply section 5, the surface mounting of an antenna becomes possible, and in case it is the assembly of equipment, productivity improves or it becomes possible to suppress dispersion in a property. Moreover, if the electric supply section 5 is not formed, since an external circuit is electrically connected with a feeder 4 by solder etc., it is desirable for the length of a feeder etc. to differ, and for dispersion to occur in a property, and to form the electric supply section 5 preferably by the coverage of **, such as solder, or the difference in an application position.
[0040] In addition, although the electrode formed with printing, plating, etc. was used with the form of this operation so that it might mention later as an electric supply means, you may embed and attach conductive member of a rod-like structure or a sheet-like object in the principal plane and the side of a substrate 1 at a binder or a substrate.
[0041] 7 is the electrode for fixation electrically connected to the ground electrode 6, and the electrode 7 for fixation is connected to the ground of an external circuit. the 2 sides in which may form 1 or two or more electrodes 7 for fixation

in each side of a substrate 1, and a substrate adjoins each other although couple [every] a total of four pieces were prepared in the side of the opposite side the side [in which the feeder 4 was formed] top of a substrate 1 with the form of this operation, respectively -- respectively -- 1 or the electrode for two or more fixation -- you may prepare -- one side -- the electrode 7 for fixation -- 1 -- or you may prepare more than one

[0042] When thinking the shock resistance after antenna mounting as important especially, it is desirable to prepare in the side on all sides and the side of the two way type which counters at least rather.

[0043] Moreover, as shown in drawing 3 , in order to secure reliability, such as soldering nature and a thermal shock resistance, it is desirable [the height H1 of the electrode 7 for fixation] that it is [of the substrate thickness L3] 30 - 50% preferably 20 to 75%. It is for a possibility of it becoming difficult to secure reliability, such as soldering nature and a thermal shock resistance, if H1 is too small, a radiation electrode and capacity coupling being caused if too large, the frequency of operation of an antenna being put out of order, or loss becoming large, and degrading antenna gain to arise.

[0044] In addition, with the form of this operation, although the electrode 7 for fixation was formed, it is not necessary to prepare especially. That is, by composition of an external circuit etc., the ground electrode 6 may be connected to the ground of a direct external circuit etc., in such a case the electrode 7 for fixation becomes unnecessary as mentioned above.

[0045] However, since dispersion in a property arises when it carries out or jointing material, such as solder, adheres to the ground electrode 6 that it is easy to do surface mounting by forming the electrode 7 for fixation, it is desirable to form the electrode 7 for fixation and to join the ground of an external circuit etc. to this electrode 7 for fixation with solder etc. preferably.

[0046] Moreover, as shown in drawing 5 , as for the ground electrode 6, it is desirable to prepare and constitute the fixed crevice T1 from the rim section of a substrate 1. It is for preventing overflowing into the substrate 1 side by the little position gap at the time of electrode formation. As for the size of a crevice T1, it is desirable preferably to prepare 500 micrometers or more at least 200 micrometers. Since the portion of the electrode 7 for fixation is attained to the side of a substrate 1 with the natural thing at this time, a crevice T1 does not exist in the portion of the electrode 7 for fixation. In addition, the crevice T1 said here is the minimum crevice.

[0047] Moreover, also as for the crevice T2 between the electric supply section 5 and the ground electrode 6, it is desirable preferably to prepare 500 micrometers or more at least 200 micrometers. This is for preventing causing unnecessary capacity coupling, if the electric supply section 5 and the ground electrode 6 approach too much, or short-circuiting electrically with soldering at the time of mounting an antenna in the circuit board. This crevice T2 shows the thing of the minimum crevice. Furthermore, it can be made to realize easily by preparing crevice 6a which hollowed the electric supply section 5 of the ground electrode 6, and the portion which counters rather than other portions and which becomes an abbreviation KO character type, for example as composition which forms a crevice T2, as shown in drawing 5 , and forming the electric supply section 5 in this crevice 6a.

[0048] Moreover, the width of face T3 of feeders 3 and 4 has 0.5-3.0 desirablemm. This is because the amount of inductance becomes large too much and it is lost, when the track width of face of feeders 3 and 4 is too small, and it is for joint capacity with the radiation electrode 2 and the ground electrode 6 becoming large too much, if too large, and causing a mismatch loss.

[0049] Moreover, although feeders 3 and 4 show only the straight track, they do not necessarily need to adhere to this, the discontinuous step section is prepared on the way, or they prepare the continuous taper section, and can make it possible to take impedance matching easily in drawing 1 -3. Moreover, by establishing two or more tracks which do not need to make feeders 3 and 4 one in abbreviation parallel, and preparing the step section and the taper section in two or more tracks, that it is easy to take adjustment of an impedance, it can carry out or the bandwidth of an antenna can be expanded.

[0050] Next, the slit 8 prepared between the radiation electrode 2 and the feeder 3 is explained using drawing 4 . It is being able to take the large inductance component of feeder 3 self by lengthening the length of the 1st feeder 3 of the effect of a slit 8 in efficiency. It can prevent that make a feeder 3 thin too much by this in order to earn a part for an inductance, and loss increases. It is being able to adjust the joint capacity between the 2nd feeder 3 and the radiation electrodes 2 of an effect. What is necessary is to extend eight slits to make joint capacity small, and just to narrow eight slits to enlarge. The 3rd is being able to make it easier to lower the frequency of operation of an antenna conjointly with the slit for frequency regulation mentioned later, and to miniaturize. It is desirable to make width of face to 2mm or less, and to make length into 30% or less of the length of the side of the radiation electrode 2 like [the width of face of this slit 8, and length] the slits 10, 11, and 12 for frequency regulation mentioned later. It is because the mode of operation of an antenna will change if width of face is too wide, loss does not increase, or desired impedance matching will no longer be acquired if it is because it becomes impossible to fulfill the below-mentioned circularly-polarized-

wave property and length is too long. Moreover, although only the slit also with this straight slit 8 was shown, it is not necessary to necessarily adhere to this, and the discontinuous step section is prepared on the way, or the continuous taper section is prepared, and it can make it possible to take impedance matching easily. Thus, that it is easy to take adjustment of an impedance, it can carry out or the bandwidth of an antenna can be expanded.
[0051] moreover, it is shown in drawing 4 -- as -- the form of this operation -- the length T4 and T5 of the slit 8 on either side -- abbreviation -- the same length -- carrying out -- width of face T6 and T7 -- abbreviation -- although considered as the same width of face, you may change the length and width of face of a slit 8 by right and left By such composition, it is easy to take the adjustment of an impedance and, moreover, adjustment of frequency becomes easy.
[0052] An alloy with the metals (Ti, nickel, etc.) of everything [electrode / for fixation / 7 (it abbreviates to each electrode hereafter) / the radiation electrode 2, the ground electrode 6, the band-like feeders 3 and 4, the electric supply section 5, and] but the metallic-material simple substances of Ag, Au, Cu, and Pd, those alloys, or the aforementioned metallic material etc. is used. In such material, since workability is very excellent in case a property and each electrode are formed, the alloy of especially Ag or Ag, and other metallic materials is used suitably. Furthermore, each electrode may be formed by the monostromatic and may consist of two or more layers more than a bilayer. That is, you may form a corrosion resistance good metallic material etc. in the front face of each electrode in order to raise a corrosion resistance, rust prevention nature, etc. Moreover, you may carry out the chemical treatment of the electrode front face for the same purpose. Furthermore, you may include at least one of oxygen, nitrogen, or the carbon in the grade which does not affect a property as an impurity at each electrode as an impurity. Moreover, the film of other metallic materials may be formed as a buffer layer between an antenna and each electrode for the purpose which raises adhesion intensity etc., or corrosion resistance good metallic material or good protective coat etc. may be formed for the purpose of protecting each electrode etc. on each electrode. a corrosion resistance good metallic material -- carrying out -- gold, platinum, titanium, etc. -- moreover, resins, such as an epoxy system and a silicon system, are mentioned as a corrosion resistance good protective coat Furthermore, you may include at least one of oxygen, nitrogen, or the carbon in the grade which does not affect a property as an impurity at each electrode as an impurity.
[0053] As for formation of each electrode etc., print processes, plating, the sputtering method, etc. are used. It is more desirable to use print processes, when it is more desirable to use the sputtering method and plating when especially the thickness of each electrode is formed comparatively thinly and it forms comparatively thickly. In the case of the gestalt of this operation, print processes were used on the grounds that productivity is good etc. The paste with which metal particles, a glass frit, solvents, etc., such as Ag, were mixed was specifically applied in the predetermined configuration on the antenna, heat treatment was added, and each electrode was formed. Moreover, as for the thickness of each electrode, it is desirable to be referred to as 0.01 micrometers - 50 micrometers (preferably 1 micrometer - 40 micrometers). If the thickness of each electrode is 0.01 micrometers or less, from a skin depth, it may become thin, the gain of an antenna may fall, it will become it easy to generate ablation of an electrode that the thickness of each electrode is 50 micrometers or more, and fault, like moreover cost becomes high will arise.
[0054] Although the configuration of the radiation electrode 2 changes with kinds of electric wave which should be transmitted and received In the case of the rectangle nothing is in the case of [of nine **** separation element] a linearly polarized wave, and clockwise rotation/anticlockwise rotation circularly-polarized-wave antenna a rectangle, a ****** form, notching, a round shape with a degeneracy separation element of the letter of a salient that have the **** separation element which consists of a height besides the shape of a rectangle which has a degeneracy separation element (triangular notching section) as shown in drawing 1 -- others -- the shape of a polygon with which circularly-polarized-wave conditions are filled (a triangle and a square -- a pentagon) It can consider as .....
[0055] However, about the **** separation element 9, if a fixed rate is exceeded, in order to cause degradation of a circularly-polarized-wave property, using under the following conditions is desirable. That is, the radiation electrode 2 of the shape of a rectangle except the **** separation element 9 is considered to be the main radiation electrode, and what doubled the degeneracy separation element 9, and this main radiation electrode and a degeneracy separation element considers other portions to be total radiation electrodes. At this time, it is desirable to make area of a degeneracy separation element 10% or less 1% or more preferably 20% or less to the area of a total radiation electrode.

[0056] Thus, the degeneracy separation element 9 can be constituted also by cutting like drawing 1 and lacking, and can be constituted also by adding in the shape of a salient. For example, you may add degeneracy separation elements, such as a rectangle and a triangle, to a square or the circular main radiation electrode. At this time, the area of being [of a total radiation electrode] 10% or less more than per % preferably 20% or less of a degeneracy separation element is the same as that of the above-mentioned case.
[0057] In the case of the radiation electrode 2 of an ellipse form, the round shape which makes the minor axis of an ellipse form one side is considered to be the main radiation electrode, and what doubled the degeneracy separation

element, and this main radiation electrode and a degeneracy separation element should just consider other portions to be total radiation electrodes. At this time, one with desirable making area of a degeneracy separation element 10% or less 1% or more preferably 20% or less to the area of a total radiation electrode is the same as that of the case of a rectangle.

[0058] with the degeneracy separation element 9 (notching section) -- in the case of the circular radiation electrode 2, it is the same as that of the case of drawing 1 , and it is desirable to make area of a degeneracy separation element 10% or less 1% or more preferably 20% or less to the area of a total radiation electrode

[0059] On the other hand, as shown in drawing 6 , the slits 10, 11, and 12 for two or more frequency regulation can be formed towards a core from the periphery of the radiation electrode 2. By this slit for frequency regulation, efficiency-resonant wavelength can be enlarged, the size of the radiation electrode 2 can be made small, and an antenna can be miniaturized. Although it can miniaturize the more the more it is necessary to adjust the width of face of slits 10, 11, and 12, length, and a number to the gain of an antenna demanded and enlarges width of face, length, and a number, since the gain of an antenna falls, it is important for it to use within the limits of the antenna gain demanded on a system. It is desirable to make width of face to 2mm or less, and to make length into 30% or less of the length of the side of a radiation electrode, and, as for a number, it is desirable to carry out to ten or less per side.

[0060] By having considered as the composition which prepares the feeder 4 and the electrode 7 for fixation which were described above, and which formed the ground electrode 6 and the electric supply section 5 on the same principal plane, and served also as the soldering section on the side like, heights, such as an electric supply pin, can be lost and the antenna in which surface mounting is possible can be realized. Moreover, it is the composition whose soldering section is visible to the substrate side, and since the check of a soldering state, i.e., a mounting state, can be checked easily, the check of an antenna of operation etc. can be performed easily.

[0061] Next, the form of operation in another form is explained using drawing 7 .

[0062] Although it is already known that a circularly-polarized-wave property will be acquired if electric power is supplied to a square and a circular radiation electrode by the degree of crossed axes angle, and 90 abbreviation, it depends for the circularly-polarized-wave property at that time on this feeder circuit greatly. It is required to fully make impedance matching and to especially, constitute the feeder circuit of low loss. This can be attained by carrying out electrode composition of low loss which the feeder ways 14a and 14b have an inductance component respectively, have a capacitance component between the radiation electrode 13 and a ground electrode (not shown), and explained with the form of the 1st operation, as shown in drawing 7 . Moreover, the electric supply section 15 used for connection with an external circuit can also be made into one place, and can mitigate the burden of an external circuit. The configuration of these feeders 14a and 14b and the electric supply section 15 and other contents except arrangement are the same as the form of the first operation of the above.

[0063] Then, an example of the attachment to the circuit board of an antenna in the form of this operation is explained.

[0064] First, it has the desired land pattern connected to a ground electrode and a feeder circuit (transceiver circuit), and the antenna of this invention is mounted on the circuit board printed / applied, and the cream solder of an amount suitable here carries out reflow processing, and solders to the circuit board. In addition, in order to raise attachment intensity at this time, you may prepare an organic binder etc. between an antenna and the circuit board. Moreover, it is desirable to cover the circuit board in the shape of a box, and to shield it using the compound plate of magnetic plates, such as conductive plates, such as a griddle, a copper plate, and an aluminum board, and a ferrite board, a conductive plate, and a magnetic plate etc., so that it may be influenced by neither the electric wave from the outside nor radiation.

[0065] Next, the application using the above-mentioned antenna is explained.

[0066] Drawing 8 is drawing showing the wireless LAN equipment which used the antenna of this invention, and is set to drawing 8 . Electronic equipment, such as wireless LAN equipment and a personal computer by which 20 and 21 were connected to 22 and 23 were connected to the wireless LAN equipments 20 and 21, respectively, A receiving means by which 24 was prepared in wireless LAN equipment 20, a transmitting means by which 25 was prepared in wireless LAN equipment 20, A receiving means by which 26 was prepared in wireless LAN equipment 21, a transmitting means by which 27 was prepared in wireless LAN equipment 21, and 28 and 29 were prepared in the wireless LAN equipments 20 and 21, respectively, and they used the antenna shown in drawing 7 from above-mentioned drawing 1 .

[0067] The data signal sent from electronic equipment 22 is modulated with the transmitting means 25, it changes into a predetermined sending signal and the sending signal is transmitted from an antenna 28 to transmit predetermined data to electronic equipment 23 from electronic equipment 22. It is received by the antenna 29, and restores to the sending signal which transmitted from the antenna 28 to a predetermined data signal with the receiving means 26, and the data signal is sent to electronic equipment 23.

[0068] Conversely, the data signal sent from electronic equipment 23 is modulated with the transmitting means 27, it changes into a predetermined sending signal and the sending signal is transmitted from an antenna 29 to transmit predetermined data to electronic equipment 22 from electronic equipment 23. It is received by the antenna 28, and restores to the sending signal which transmitted from the antenna 29 to a predetermined data signal with the receiving means 24, and the data signal is sent to electronic equipment 22.
[0069] With the wireless LAN equipments 20 and 21 constituted as mentioned above, since antennas 28 and 29 can be miniaturized very much, it moreover receives horizontally and directivity of a transceiver property can be enlarged, while limitation of arrangement of the wireless LAN equipments 20 and 21, the arrangement place of antennas 28 and 29, etc. decreases and a layout becomes easy, data communication can be performed certainly.
[0070] In addition, although explained using wireless LAN equipment, a use is not necessarily limited to the above-mentioned contents, and can be widely applied in a radio device here.
[0071] Next, one form of operation of antenna equipment is explained using drawing 9 .
[0072] The radome (covering) for the antenna which becomes this invention with above-mentioned 16, and 17a and 17b protecting this antenna equipment in drawing 9 , or securing weatherability, such as waterproofing, and 18 The low noise amplifier substrate in which electronic parts, such as a semiconductor, a filter, resistance, and a capacitor, were mounted, The coaxial cable and 19b which transmit it to a digital disposal circuit after 19a amplifies the signal received with the antenna with low noise amplifier, or supply power to low noise amplifier are a connector for connecting this antenna equipment to a digital disposal circuit or a power supply electrically. This antenna equipment can be easily installed in the place which was most suitable for transmission and reception of the antenna equipment which is separated from a digital disposal circuit or a power supply, and various application uses can be made to suit flexibly by considering as the antenna equipment which consists of such composition. Moreover, the antenna and the low noise amplifier which become this invention are protected from dust, a shock, etc., ** can also do ****** from a rainstorm, high humidity, etc., and the antenna equipment holding high-reliability can be offered.
[0073]
[Effect of the Invention] The radiation electrode which this invention countered one principal plane of a substrate and a substrate, and was prepared, It connects with the ground electrode countered and prepared in the principal plane of another side of a substrate, and a radiation electrode electrically. And while being prepared for the both sides of one [at least] principal plane and the side of a substrate, and a ground electrode is equipped with the electric supply means prepared in non-contact and an electric supply means has an inductance component By having considered as the composition which has a capacitance component in an electric supply means, between radiation electrodes and an electric supply means, and each ground inter-electrode, there is no electric supply pin, automatic mounting is possible, and manufacture is easy, the yield is high and it becomes still easier to property adjust it.

[Translation done.]

* NOTICES *

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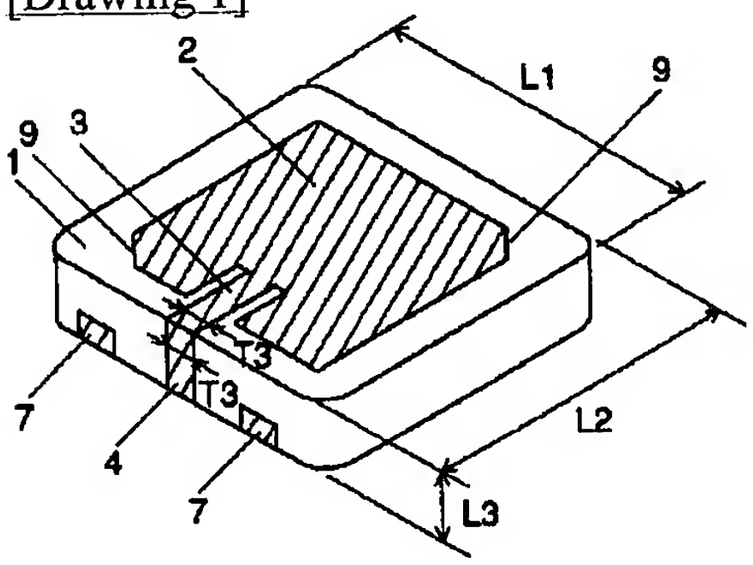
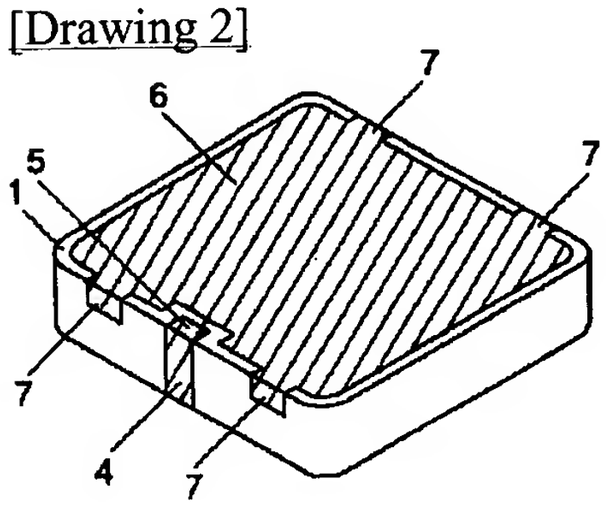
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

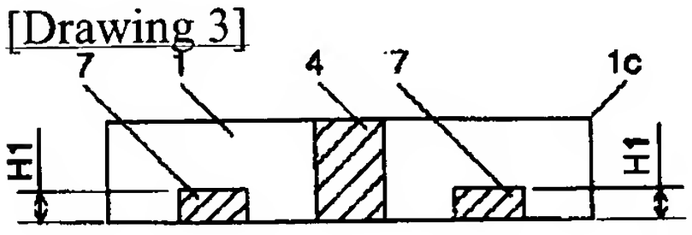
[Drawing 1]



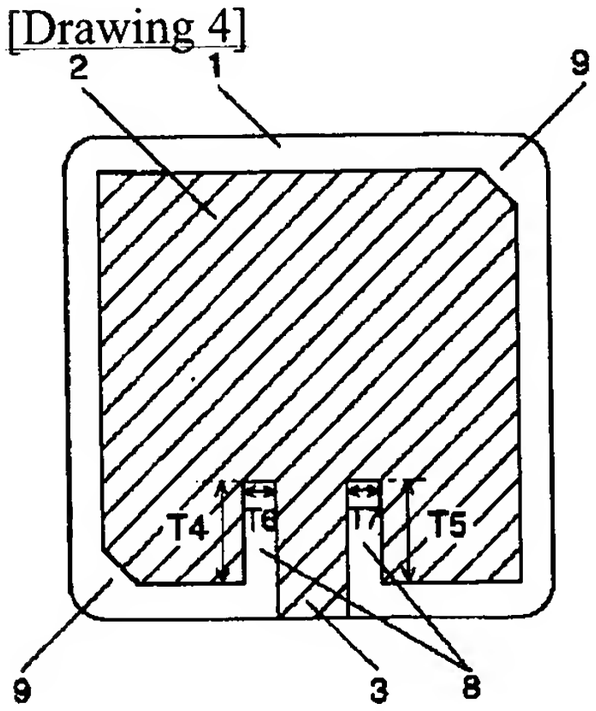
[Drawing 2]



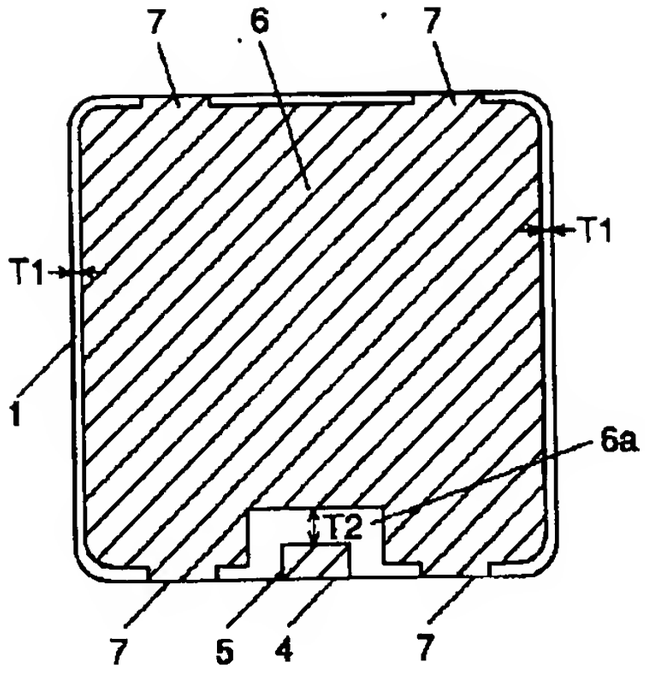
[Drawing 3]



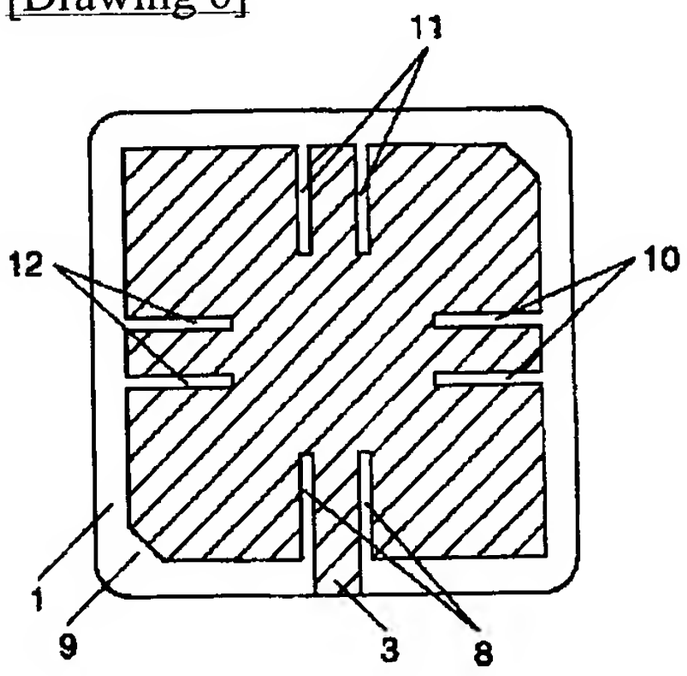
[Drawing 4]



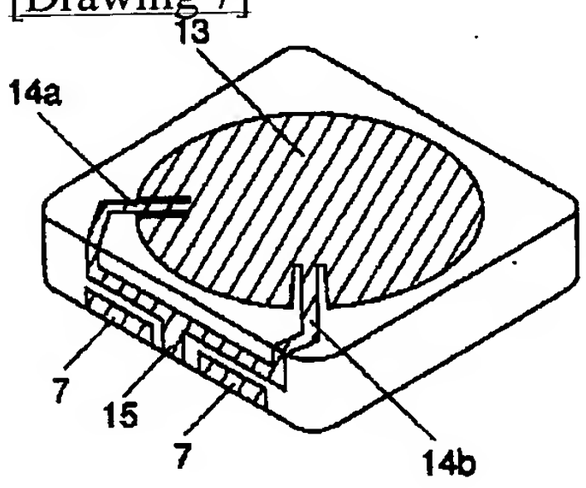
[Drawing 5]



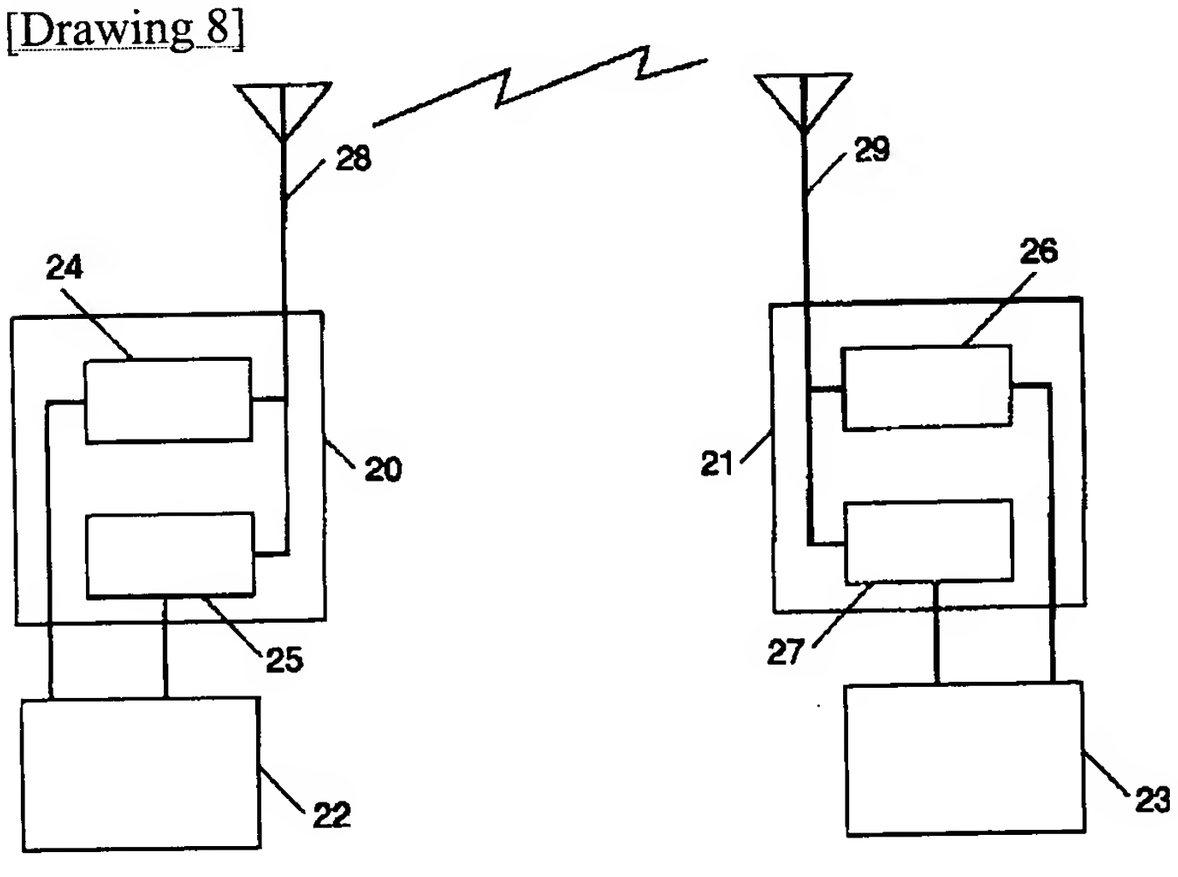
[Drawing 6]



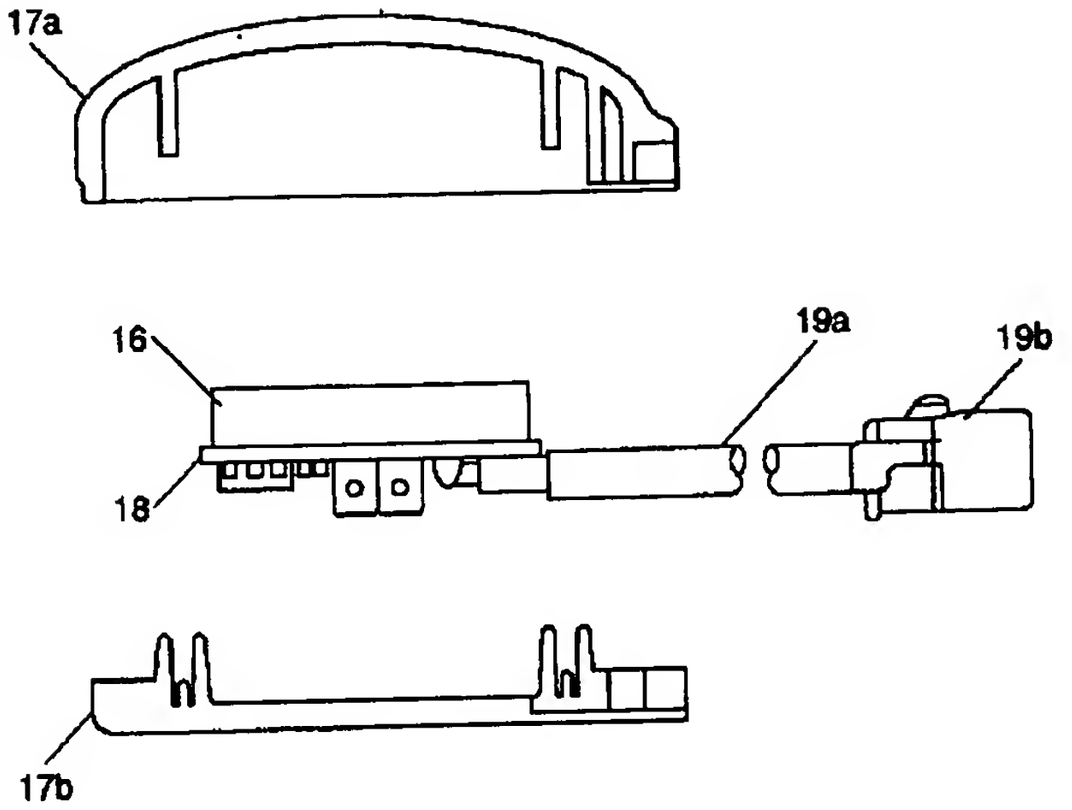
[Drawing 7]



[Drawing 8]



[Drawing 9]



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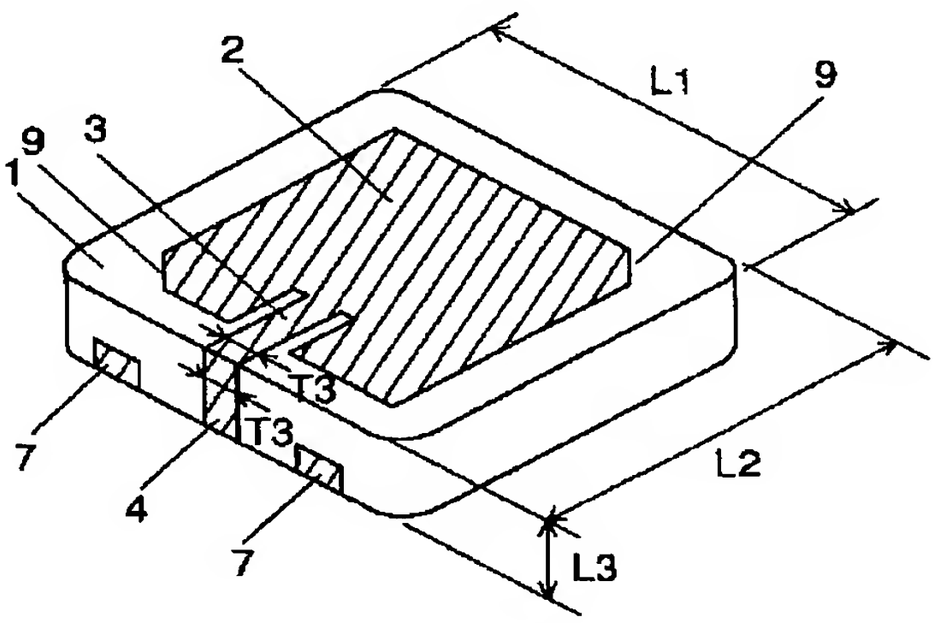
最終頁に続く

(54)【発明の名称】　アンテナ及びアンテナ装置及び電子機器

(57)【要約】
【課題】　面実装が可能な小型、高利得、高信頼性のアンテナを提供することを目的とする。
【解決手段】　基板１の一方の主面に放射電極２、基板１の他方の主面に対向してアース電極６を、基板側面には固定用電極７を、基板１の側面及び基板１の両主面に放射電極２と電気的に接合し、アース電極６とは非接触に、かつ、その自身がインダクタンス成分を有し、放射電極２、及びアース電極６間でキャパシタンス成分を有する整合回路となる帯状の給電電極を配設した。



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【特許請求の範囲】

【請求項１】基板と、前記基板の一方の主面に対向して設けられた放射電極と、前記基板の他方の主面に対向して設けられたアース電極と、前記放射電極と電気的に接続され、しかも少なくとも前記一方の主面と前記基板の側面の双方に設けられるとともに前記アース電極とは非接触に設けられた給電手段を備え、前記給電手段がインダクタンス成分を有すると共に、前記給電手段と前記放射電極の間、前記給電手段と前記アース電極間それぞれにキャパシタンス成分を有する事を特徴とするアンテナ。

【請求項２】基板の一方の主面上における給電手段において、前記給電手段の両側にスリットを設けることによって、前記スリットを介して、前記給電手段と前記放射電極が対向する部分を有する事を特徴とする請求項１記載のアンテナ。

【請求項３】給電手段は、基板の放射電極を形成した主面に設けられた第１の給電線と、前記主面に隣接した側面上に設けられた第２の給電線と、前記主面と反対側の主面に設けられた給電部と有する事を特徴とする請求項１，２いずれか１記載のアンテナ。

【請求項４】給電手段を複数備えの円偏波からなる電波の送受信を目的とする事を特徴とする請求項１～３いずれか１記載のアンテナ。

【請求項５】基板の比誘電率εｒは４以上１５０以下である事を特徴とする請求項１～４いずれか１記載のアンテナ。

【請求項６】基板の表面粗さを５０μｍ以下とした事を特徴とする請求項１～５いずれか１記載のアンテナ。

【請求項７】基板をセラミックで構成するとともに、焼結密度を９２％以上とした事を特徴とする請求項１～６いずれか１記載のアンテナ。

【請求項８】基板を誘電正接が０．００５以下の樹脂で構成した事を特徴とする請求項１～７いずれか１記載のアンテナ。

【請求項９】基板の角部に面取り加工かテーパー加工の少なくとも一方を施すことを特徴とする請求項１～８いずれか１記載のアンテナ。

【請求項１０】面取り加工としてＣ面取り加工を採用するとともに、Ｃ面取りのＲを０．１ｍｍ以上とした事を特徴とする請求項９記載のアンテナ。

【請求項１１】電極材料を、抵抗率が１×１０$^{-4}$Ωｃｍ以下の金属材料とし、電極厚みを０．０１μｍ～５０μｍとすることを特徴とする請求項１～１０記載のアンテナ。

【請求項１２】請求項１～１１に記載してなる前記アンテナと、前記アンテナのアース電極の裏面側にローノイズアンプ基板を接合し、前記ローノイズアンプ基板への電源供給、入出力信号の授受を行う同軸ケーブルを備える構成としたことを特徴とするアンテナ。

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【請求項１３】人工衛星もしくは、地上の基地局から無線で送られてくるデータを受信する装置であって、請求項１～１２いずれか１記載のアンテナと、前記アンテナで受信した受信信号を復調してデータ信号を生成する手段と、前記データ信号を音声もしくは、映像として出力する手段とを備えた事を特徴とする無線受信装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、無線データ通信、衛星通信、等の移動体通信やＧＰＳ等のナビゲーション用のアンテナとして用いられるマイクロストリップを用いたアンテナ及びアンテナ装置及び電子機器に関するものである。

【０００２】

【従来の技術】近年、２．４ＧＨｚ帯無線ＬＡＮ、衛星用ＤＡＢ、及びＧＰＳ等のナビゲーション用のアンテナとして用いられるマイクロストリップアンテナが広く用いられるようになった。それは、このアンテナが、従来の線状アンテナに比べて小型・薄型化が可能であるため機器の小型化、薄型化に大きく寄与したためである。しかしながら従来のマイクロストリップアンテナは、例えば特開平５－１９９０３２号公報に示されるように、放射電極への給電手段としては、金属導体から成るリベット状の給電ピンを用いるのが一般的であった。

【０００３】

【発明が解決しようとする課題】このような給電ピンにより給電を行うマイクロストリップアンテナでは、自動実装が困難であり、給電ピンが基板外部に突出しているため、輸送時に特別な配慮を必要とし、かつ取り扱い難いなどの問題点がある上、インピーダンス整合からくる制約があるため、給電ピンを、どうしても基板のほぼ中央部に設けざるを得ず、外部回路との接続が最も容易な基板端部に給電部を設けることが非常に困難であった。

【０００４】また面実装用として積層アンテナも提案されているが、この積層アンテナは生産設備が過大で、製造コストが高く、また電極をセラミック基板間に挟んだ状態で焼成するので、焼成条件が非常に厳しく、工程不良の発生率がきわめて高い。更に焼成して出来上がったアンテナの特性が基準からずれている場合の特性の調整が非常に困難であると言う問題点があった。

【０００５】本発明は、上記従来の課題を解決するもので、給電ピンがなく、自動実装可能で、かつ、製造が容易で、歩留りが高く、さらに特性調整の容易なアンテナ及びアンテナ装置及び電子機器を提供することを目的とする。

【０００６】

【課題を解決するための手段】本発明は、基板と、基板の一方の主面に対向して設けられた放射電極と、基板の他方の主面に対向して設けられたアース電極と、放射電極と電気的に接続され、しかも少なくとも一方の主面と

基板の側面の双方に設けられるとともにアース電極とは非接触に設けられた給電手段を備え、給電手段がインダクタンス成分を有すると共に、給電手段と放射電極の間、給電手段とアース電極間それぞれにキャパシタンス成分を有する構成とした。

【０００７】

【発明の実施の形態】請求項１記載の発明は、基板と、前記基板の一方の主面に対向して設けられた放射電極と、前記基板の他方の主面に対向して設けられたアース電極と、前記放射電極と電気的に接続され、しかも少なくとも前記一方の主面と前記基板の側面の双方に設けられるとともに前記アース電極とは非接触に設けられた給電手段を備え、前記給電手段がインダクタンス成分を有すると共に、前記給電手段と前記放射電極の間、前記給電手段と前記アース電極間それぞれにキャパシタンス成分を有する事によって、給電ピンがなく、自動実装可能で、かつ、製造が容易で、歩留りが高く、さらに特性調整が容易となる。

【０００８】請求項２記載の発明は、請求項１において、基板の一方の主面上における給電手段において、前記給電手段の両側にスリットを設けることによって、前記スリットを介して、前記給電手段と前記放射電極が対向する部分を有する事によって、効果の第１は、給電手段の長さを実効的に長くすることによって、給電手段自身のインダクタンス成分を大きく取れることである。これにより、インダクタンス分を稼ぐために給電手段を細くし過ぎて、損失が増加することを防止することができる。効果の第２は、給電手段と放射電極間の結合容量を調節できることである。結合容量を小さくしたいときは、スリット幅を広げ、大きくしたいときは、スリット８幅を狭くすればよい。第３はアンテナの動作周波数を下げ、より小型化しやすくできることである。

【０００９】請求項３記載の発明は、請求項１，２において、給電手段は、基板の放射電極を形成した主面に設けられた第１の給電線と、前記主面に隣接した側面上に設けられた第２の給電線と、前記主面と反対側の主面に設けられた給電部と有する事によって、面実装が容易になり、しかも特性のばらつきを抑えることができる。

【００１０】請求項４記載の発明は、請求項１～３において、給電手段を複数備えの円偏波からなる電波の送受信をする事ができる小型の自動実装可能な平面アンテナを提供することができる。

【００１１】請求項５記載の発明は、請求項１～４において、基板の表面粗さを５０μｍ以下とした事によって、Q値の低下を防止することができ、アンテナの利得を向上させることができる。

【００１２】請求項６記載の発明は、請求項１，５において、基板の比誘電率εｒは４以上１５０以下とすることによって、アンテナの小型化を促進することができ、共振周波数の帯域を広くでき、さらには、特性のばらつきを抑えることができる。

【００１３】請求項７記載の発明は、請求項１～６において、基板をセラミックで構成するとともに、焼結密度を９２％以上とした事によって機械的強度を向上させることができるとともに加工性なども良く、更には、安定した特性を得ることができるとともに、Q値の低下や比誘電率の低下を防止できる。

【００１４】請求項８記載の発明は、請求項１～７において、基板を誘電正接が０．００５以下の樹脂で構成した事によって機械的強度を保ちながら、軽量化を図り加工性なども良く、更には、安定した特性を得ることができるとともに、Q値の低下や比誘電率の低下を防止できる。

【００１５】請求項９記載の発明は、請求項１～８において、基板の角部に面取り加工かテーパー加工の少なくとも一方を施すことによって、板の角部の大きな欠けを防止できるので、使用途中でアンテナの特性が大きく変化し、不具合が生じることはない。

【００１６】請求項１０記載の発明は、請求項９において、面取り加工としてＣ面取り加工を採用するとともに、Ｃ面取りのＲを０．１ｍｍ以上としたことによって、確実にしかも生産性良くアンテナを生産することができる。

【００１７】請求項１１記載の発明は、請求項１～１０において、電極材料を、抵抗率が１×１０$^{-4}$Ωｃｍ以下の金属材料とし、電極厚みを０．０１μｍ～５０μｍとすることによって、Q値の低下や導体損の増加を防止でき、低損失で、高利得のアンテナを得ることができる。

【００１８】請求項１２記載の発明は、請求項１～１０において、アンテナと、前記アンテナのアース電極の裏面側にローノイズアンプ基板を接合し、前記ローノイズアンプ基板への電源供給、入出力信号の授受を行う同軸ケーブルを備える構成としたことによって前記アンテナを安定に保持し効率の良い送受信特性を得ることができ、また、アンテナが送受信する電波を効率よく増幅し、確実に信号処理回路と信号のやりとりができる。

【００１９】請求項１３記載の発明は、人工衛星もしくは、地上の基地局から無線で送られてくるデータを受信する装置であって、請求項１～１２いずれか１記載のアンテナと、前記アンテナで受信した受信信号を復調してデータ信号を生成する手段と、前記データ信号を音声もしくは、映像として出力する手段とを備える事によって、配置場所などの限定が少なくなって、装置のレイアウトなどがしやすくなるとともに、確実にデータ通信を行うことができる。また、アンテナが非常に大きな耐久性を有するので、無線ＬＡＮ装置の設置条件が広範囲になる。さらに、アンテナが外部に大きく突出することがないので、破損などの不具合が生じることはない。

【００２０】以下、本発明におけるの実施の形態について説明する。

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【００２１】図１，２，３はそれぞれ本発明の一実施の形態におけるアンテナを示す表面斜視図，裏面斜視図及び給電手段側の側面図である。

【００２２】図１，２，３において、１は基板で、基板１は誘電体材料で構成される。基板１の比誘電率εｒは４以上１５０以下（好ましくは１８以上１３０以下）であることが好ましい。基板１の比誘電率εｒが４より小さいと、基板１が大きくなりすぎてアンテナの小型化を行うことができず、比誘電率εｒが１５０より大きいと、共振周波数帯域が狭くなりすぎて、ちょっとした組成の違いや、欠けなどの発生によって共振周波数帯域が外れてしまい、所定の特性を得ることはできないとともに、特性のばらつきが大きくなるという不具合が生じる。

【００２３】また、比誘電率εｒが４以上１２以下の領域では、Ｑ値の低下の少なく誘電正接が０．００５以下の樹脂基板が基板１として好適に用いられ、また、６以上１５０以下の領域においては、同様に、Ｑ値の低下の少ない、誘電正接が０．００５以下のセラミック基板が基板１として好適に用いられる。

【００２４】基板１の具体的構成材料としては、ガラス／フッ素樹脂、ガラス／熱硬化ＰＰＯ樹脂、ＢＴレジン、セラミック粉末ＰＴＦＥ積層板、セラミック／ウィスカ等の樹脂系基板、フォルステライト、アルミナ系、チタン酸マグネシウム系やチタン酸カルシウム系、ジルコニア・スズ・チタン系、チタン酸バリウム系や鉛・カルシウム・チタン系等のセラミック基板などが挙げられる。これらの構成材料のなかでも、耐候性が良く、機械的強度が大きく、安価であることを考慮すると、セラミックを用いることが好ましい。セラミックを基板の構成材料として用いる場合、抗析力などを大きくするために焼結密度は９２％以上（より好ましくは９５％以上）が好ましい。焼結密度が９２％以下であると、Ｑ値の低下や比誘電率εｒが低下することがあり、不具合が生じる。

【００２５】また、基板１の表面粗さは、後述する電極との界面における特性のばらつきを抑制するために、５０μｍ以下（特に好ましくは１０μｍ以下、更に好ましくは５μｍ以下）とすることが好ましい。表面粗さが５０μｍ以上であると、電極の導体損を増加させアンテナの絶対利得の低下を招くと共に、実効誘電率のばらつき要因となり、アンテナの共振周波数のずれを引き起こし、所望の周波数におけるアンテナ利得が下がることがある。

【００２６】基板１の形状は、図１，２，３に示す様な＊

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＊方形板状や、多角形板状（断面が三角形，四角形，五角形・・・・・）とすることができる。この時、多角形板状とする場合には、各辺が略等しい多角形状とすることが実装性や特性の面で好ましい。

【００２７】また、本実施の形態では、基板１の厚みを均一に（中央部と端部の厚さがほぼ同じ）する事によって、特性の均一化または特性の安定化を行うことができるが、使用状況や、使用機械の種類等によって、基板１の厚みを所定の部分間で異ならせても良い。即ち、例えば、基板１に複数の凹部や段差部を形成したり、基板１の一方の端部の厚みを反対側の端部の厚みよりも厚くしたり薄くしたりすることができる。

【００２８】更に、基板１の角部には面取りやテーパーなどを施すことによって、基板１の角部１ｃに大きな欠けなどが発生して特性が変化することを防止できる。

【００２９】従って、前述の様に、基板１の角部に予め、面取りやテーパー等を施しておくことによって、送信や受信特性が途中で基板１の角部１ｃに大きな欠けが生じることによって変化することはほとんどなくなる。

【００３０】この時、生産性や確実な角部処理が施せる事などを考慮すると、Ｃ面取り、もしくは、Ｒ処理を施すことが好ましい。この時のＣ面取り、Ｒ処理によるコーナー処理は、０．１ｍｍ以上（好ましくは０．２ｍｍ以上）とすることによって、ちょっとした衝撃などが基板１に加わっても、基板１の角部の欠け等の発生はほとんどなくなり、もし基板１が欠けるほど大きな衝撃などが加わったとしても、ほんのわずかな欠けしか発生せず、送信や受信特性の大きな変化が生じることはない。この基板１の面取りやテーパー加工等は、基板１を構成する材料が何であれ、必要であるが、上述の様に比較的欠けが発生しやすいセラミックを用いた場合には、特に有効である。更に、他の実施の形態として、基板１の角部にＣ面取りやテーパー加工を施さずに、基板１の角部に、欠け防止を行う有機系の樹脂などを設ける事によって、角部の大きな欠けを防止できる。

【００３１】このような欠け防止対策を行うことにより、欠けの発生による工程不良を抑制でき、アンテナの生産性・歩留りを向上させることができる。

【００３２】また、アンテナの幅をＬ１（ｃｍ）、長さをＬ２（ｃｍ）、厚さをＬ３（ｃｍ）としたときに下記の条件を満たすことにより、アンテナの動作周波数を最適にすると共に、外形寸法を最小にすることができるので、アンテナを安定に供給できると共に利得や帯域幅を適正に確保することができる。

【００３３】

$$0.7\times\lambda 0\div(2\times\varepsilon r^{1/2})\leqq L1\leqq 2.0\times\lambda 0\div(2\times\varepsilon r^{1/2})$$

$$0.7\times\lambda 0\div(2\times\varepsilon r^{1/2})\leqq L2\leqq 2.0\times\lambda 0\div(2\times\varepsilon r^{1/2})$$

$$0.08\leqq L3\leqq 0.5$$

ここで、λ０は、アンテナを動作させる際の中心周波数における自由空間波長（単位：ｃｍ）を、εｒは、アンテナに使用する基板１の構成材料の比誘電率を表している。厚さＬ３において上記範囲を下回ると、アンテナ自

体の機械的強度が低くなり、割れなどが発生しやすくなるとともに、利得の低下や帯域幅の減少を招き、安定した電波の送受信ができなくなってしまう。また、上記範囲を上回ると、アンテナ形状が大きくなりすぎて小型化、薄型化のメリットを損ねる事になってしまう。

【００３４】図１，２，３において、２は基板１の一方の主面に設けられた円偏波を実現するための縮帯分離素子９を備えた方形状の放射電極である。

【００３５】６は基板１のもう一方の主面に放射電極２に対向して設けられたアース電極である。

【００３６】また、給電手段は基板１の側面及び両主面に放射電極と電気的に接合し、アース電極６とは非接触に設けられている。

【００３７】給電手段は給電線３，４及び給電部５で構成されており、給電線３は基板１における放射電極２を形成した主面上に設けられ、帯状体形状をしており、しかも給電線３自体でインダクタンス成分を有すると共に、放射電極２と給電線３の間、アース電極６と給電線３の間にそれぞれキャパシタンス成分を構成している。また、給電線３は好ましくは放射電極２と一体に形成されていると共に、しかも後述に示すように、給電線３は両端にスリット８を介して放射電極２と対向している部分を有している。なお、本実施の形態では、給電線３と放射電極２を一体で形成したが、給電線３及び放射電極２を隔離して基板１の同一主面上に設け、それらを半田などの導電性部材で電気的に接合させても良い。

【００３８】更に給電線４は、基板１の主面と略垂直に設けられた側面上に形成されており、に設けられた帯状体形状を有しており、やはり給電線４自体でインダクタンス成分を有すると共に、放射電極２と給電線４の間、アース電極６と給電線４の間にそれぞれキャパシタンス成分を有し、各々整合回路の一部を構成している。給電線４は給電線３に電気的に接続されており、本実施の形態では、給電線３，４は一体構成とした。しかしながら、前述の通り、給電線３，４を隔離して設け、それらの間を半田などの部材によって、電気的に接続した構成でも良い。

【００３９】また、給電部５は、アース電極６と同じ基板１の主面上に設けられ、外部回路に接続される。給電部５は給電線４に電気的に接続されており、本実施の形態では、給電線４と給電部５は一体構成とした。しかしながら、前述の通り、給電線４と給電部５を隔離して設け、それらの間を半田などの部材によって、電気的に接続した構成でも良い。更に、給電部５の主目的は外部回路と接合されることで給電手段と外部回路とを電気的に接続することであり、給電線４を外部回路との接続に用いる場合には、不要となり、この場合には給電手段は給電線３，４にて構成されることになる。なお、給電部５を設けることで、アンテナの面実装が可能となり、装置の組立の際に、生産性が向上したり、特性のばらつきを

抑えることが可能となる。又、給電部５を設けなければ、半田などによって、給電線４と外部回路が電気的に接続されるので、半田などのの塗布量や塗布位置の違いによって、給電線の長さ等が異なることになり、特性にばらつきが発生する可能性があり、好ましくは給電部５を設けることが好ましい。

【００４０】なお、本実施の形態では、給電手段として後述するように印刷やメッキ法などで形成された電極を用いたが、棒状体やシート状体の導電部材を基板１の主面や側面に接着材や基板に埋め込んだりして取り付けたりしてもよい。

【００４１】７はアース電極６に電気的に接続された固定用電極で、固定用電極７は外部回路のアースに接続される。本実施の形態では、給電線４が設けられた基板１の側面上と、その反対側の側面にそれぞれ一対ずつ計４個設けたが、基板１の各側面に１乃至複数の固定用電極７を設けても良いし、基板の隣り合う２側面にそれぞれ１乃至複数固定用電極を設けても良いし、一つの側面にのみ固定用電極７を１乃至複数個設けても良い。

【００４２】特に、アンテナ実装後の耐衝撃性を重視する場合には、むしろ、四方の側面、少なくとも対向する二方の側面に設けることが好ましい。

【００４３】又、図３に示すように、固定用電極７の高さＨ１は、はんだ付け性、耐熱衝撃性などの信頼性を確保するために、基板厚みＬ３の２０～７５％、好ましくは、３０～５０％であることが望ましい。Ｈ１が小さすぎるとはんだ付け性、耐熱衝撃性などの信頼性を確保することが難しくなり、大きすぎると放射電極と容量結合をおこし、アンテナの動作周波数を狂わせたり、損失が大きくなったりしてアンテナ利得を劣化させる恐れが生じるためである。

【００４４】なお、本実施の形態では、固定用電極７を設けたが、特に設けなくても良い。すなわち、外部回路の構成等によっては、アース電極６を直接外部回路のアース等に接続する場合が有り、この様な場合には、上述の様に固定用電極７は不要となる。

【００４５】しかしながら、固定用電極７を設けることによって、面実装をやりやすくしたり、アース電極６に半田などの接合材が付着することによって、特性のばらつきが生じるので、好ましくは、固定用電極７を設け、この固定用電極７と外部回路のアースなどとを半田などで接合することが好ましい。

【００４６】又、アース電極６は、図５に示すように、基板１の外縁部から一定の隙間Ｔ１を設けて構成するのが望ましい。電極形成時のちょっとした位置ずれによって、基板１側面にはみ出してしまうのを防止するためである。隙間Ｔ１の大きさは、少なくとも２００μｍ、好ましくは、５００μｍ以上設けることが望ましい。この時、固定用電極７の部分は当然の事ながら基板１の側面まで達しているので、固定用電極７の部分には隙間Ｔ１

は存在しない。なお、ここで言う隙間Ｔ１とは最小隙間のことである。

【００４７】また、給電部５とアース電極６との隙間Ｔ２もまた、少なくとも２００μｍ、好ましくは、５００μｍ以上設けることが望ましい。これは、給電部５とアース電極６が接近しすぎると不要な容量結合をおこしたり、アンテナを回路基板に実装する際のはんだ付けによって、電気的にショートしたりするのを防止するためである。この隙間Ｔ２は最小隙間の事を示している。更に、隙間Ｔ２を設ける構成としては、図５に示すようにアース電極６の給電部５と対向する部分を他の部分よりも窪ませた例えば略コ字型になるような凹部６ａを設け、この凹部６ａ内に給電部５を設けることで、容易に実現させることができる。

【００４８】また、給電線３，４の幅Ｔ３は、０．５～３．０ｍｍが望ましい。これは、給電線３，４の線路幅が小さすぎるとインダクタンス分が大きくなりすぎて、損失になってしまうためであり、大きすぎると放射電極２及びアース電極６との結合容量が大きくなりすぎて、不整合損失を招いてしまうためである。

【００４９】又、図１～３では、給電線３，４はストレートな線路のみを示しているが、必ずしもこれにこだわる必要はなく、途中に不連続なステップ部を設けたり、連続的なテーパー部を設けて、インピーダンス整合が容易に取れるようにすることができる。また、給電線３，４を１本にする必要もない、複数の線路を略平行に設けてもよく、複数の線路にステップ部やテーパー部を設けることによって、インピーダンスの整合を取りやすくしたり、アンテナの帯域幅を拡大したりすることができる。

【００５０】次に、放射電極２と給電線３との間に設けられたスリット８について、図４を用いて説明する。スリット８の効果の第１は、給電線３の長さを実効的に長くすることによって、給電線３自身のインダクタンス成分を大きく取れることである。これにより、インダクタンス分を稼ぐために給電線３を細くし過ぎて、損失が増加することを防止することができる。効果の第２は、給電線３と放射電極２間の結合容量を調節できることである。結合容量を小さくしたいときは、スリット８幅を広げ、大きくしたいときは、スリット８幅を狭くすればよい。第３は、後述する周波数調整用スリットと相まって、アンテナの動作周波数を下げ、より小型化しやすくできることである。このスリット８の幅、及び長さは、後述する周波数調整用スリット１０，１１，１２と同様に、幅は２ｍｍ以下、長さは放射電極２の辺の長さの３０％以下にするのが望ましい。なぜなら、幅が広すぎるとアンテナの動作モードが変わり損失が増加したり、後述の円偏波特性を満たすことができなくなるためであり、長さが長すぎると、所望のインピーダンス整合が得られなくなってしまうからである。また、このスリット

８もストレートなスリットのみを示したが、必ずしもこれにこだわる必要はなく、途中に不連続なステップ部を設けたり、連続的なテーパー部を設けて、インピーダンス整合が容易に取れるようにすることができる。このようにして、インピーダンスの整合を取りやすくしたり、アンテナの帯域幅を拡大したりすることができる。

【００５１】また、図４に示す様に、本実施の形態では、左右のスリット８の長さＴ４，Ｔ５を略同じ長さとし、幅Ｔ６，Ｔ７を略同じ幅としたが、スリット８の長さや幅を左右で異ならせても良い。この様な構成によって、インピーダンスの整合性を取りやすく、しかも周波数の調整が容易になる。

【００５２】放射電極２，アース電極６，帯状の給電線３，４，給電部５，固定用電極７（以下、各電極と略す）は、Ａｇ，Ａｕ，Ｃｕ、Ｐｄの金属材料単体、あるいはそれらの合金、若しくは、前記金属材料の他の金属（Ｔｉ，Ｎｉ等）との合金などが用いられる。これらの材料の中で、特にＡｇあるいは、Ａｇと他の金属材料との合金は、特性及び各電極を形成する際に作業性が非常に優れているので好適に用いられる。更に、各電極は、一層で形成しても良いし、二層以上の複数層で構成しても良い。即ち、各電極の表面に、耐腐食性、防錆性などを向上させる目的等で、耐食性の良い金属材料等を形成しても良い。また、同様の目的で、電極表面を化学処理しても良い。更に各電極には、不純物として、特性に影響を及ぼさない程度に、酸素や窒素や炭素の少なくとも１つを不純物として含ませてもよい。また、アンテナと各電極の間に、密着強度などを向上させる目的等で、他の金属材料の膜をバッファ層として形成したり、各電極上に、各電極を保護するなどの目的等で、耐食性の良い金属材料または保護膜等を形成しても良い。耐食性の良い金属材料としは金、白金、チタンなどが、また耐食性の良い保護膜としては、エポキシ系、シリコン系などの樹脂が挙げられる。更に各電極には、不純物として、特性に影響を及ぼさない程度に、酸素や窒素や炭素の少なくとも１つを不純物として含ませてもよい。

【００５３】各電極等の形成は、印刷法やメッキ法及びスパッタリング法などが用いられる。特に各電極の膜厚を比較的薄く形成する場合には、スパッタリング法やメッキ法を用いたほうが好ましく、比較的厚く形成する場合には、印刷法を用いる方が好ましい。本実施の形態の場合、生産性が良好である事などを理由として印刷法を用いた。具体的には、Ａｇ等の金属粒子とガラスフリット及び溶媒などを混ぜたペーストをアンテナ上に所定の形状で塗布し、熱処理を加えて、各電極を形成した。また、各電極の膜厚は０．０１μｍ～５０μｍ（好ましくは１μｍ～４０μｍ）とすることが好ましい。各電極の膜厚が０．０１μｍ以下であると、スキンデプスより薄くなりアンテナの利得が低下することがあり、各電極の膜厚が５０μｍ以上であると、電極の剥離が発生しやす

くなり、しかもコストが高くなる等の不具合が生じる。

【００５４】放射電極２の形状は、送受信するべき電波の種類によって異なるが、直線偏波の場合は縮帯分離素子９の無い方形、右旋回／左旋回円偏波アンテナの場合、図１に示すような縮退分離素子（三角形の切り欠き部）を有する方形状の他に、突起部からなる縮帯分離素子を有する方形、や楕円形、切り欠きや突起状の縮退分離素子付き円形、などの他、円偏波条件を満たす多角形状（三角形，四角形，五角形・・・・・）とすることができる。

【００５５】但し、縮帯分離素子９については、一定の割合を越えると円偏波特性の劣化を招くため以下のような条件下で用いることが好ましい。すなわち縮帯分離素子９を除いた方形状の放射電極２を主放射電極と考え、その他の部分を縮退分離素子９、そして、この主放射電極と縮退分離素子を合わせたものが全放射電極と考える。この時、全放射電極の面積に対して縮退分離素子の面積は、２０％以下、好ましくは、１％以上１０％以下にするのが望ましい。

【００５６】このように、縮退分離素子９は、図１のように切り欠くことによっても構成でき、突起状に加えることによっても構成できる。例えば、正方形や円形の主放射電極に、長方形や三角形等の縮退分離素子を追加しても良い。この時、縮退分離素子の面積が、全放射電極の２０％以下、好ましくは、１％以上１０％以下であるのは上記の場合と同様である。

【００５７】楕円形の放射電極２の場合は、楕円形の短軸を一辺とする円形を主放射電極と考え、その他の部分を縮退分離素子、そして、この主放射電極と縮退分離素子を合わせたものが全放射電極と考えれば良い。この時、全放射電極の面積に対して縮退分離素子の面積は、２０％以下、好ましくは、１％以上１０％以下にするのが望ましいのは長方形の場合と同様である。

【００５８】縮退分離素子９（切り欠き部）付き円形の放射電極２の場合は、図１の場合と同様であり、全放射電極の面積に対して縮退分離素子の面積は、２０％以下、好ましくは、１％以上１０％以下にするのが望ましい。

【００５９】一方、図６に示すように、放射電極２の周辺部から中心部に向けて、複数の周波数調整用のスリット１０，１１，１２を設けることができる。この周波数調整用スリットによって、実効的な共振波長を大きくすることができ、放射電極２の大きさを小さくすることができ、アンテナを小型化することができる。スリット１０，１１，１２の幅、長さ、本数は、要求されるアンテナの利得に対して調整する必要があり、幅、長さ、本数を大きくすればするほど小型化することができるが、アンテナの利得は低下していくので、システム上要求されるアンテナ利得の範囲内で用いることが重要である。幅は２mm以下、長さは放射電極の辺の長さの３０％以下

にするのが望ましく、本数は、一辺当たり１０本以下とするのが望ましい。

【００６０】以上述べたように、アース電極６と給電部５を同一主面上に形成し、その側面にはんだ付け部も兼ねた、給電線４及び固定用電極７を設ける構成としたことにより、給電ピン等の突起部をなくすことができ、面実装が可能なアンテナを実現することができる。また基板側面にはんだ付け部が見えるような構成であり、はんだ付け状態の確認すなわち、実装状態を容易に確認することができるので、アンテナの動作確認等を簡単に行うことができる。

【００６１】次に、別な形態における、実施の形態について、図７を用いて説明する。

【００６２】正方形，円形の放射電極に交差角度、略９０度で給電すると円偏波特性が得られることはすでに知られているが、その時の円偏波特性は、この給電回路に大きく依存する。とりわけインピーダンス整合が十分にでき、低損失の給電回路を構成することが必要である。これは、図７に示すように、給電線路１４ａ，１４ｂが各々インダクタンス成分を有し、放射電極１３及びアース電極（図示せず）間でキャパシタンス成分を有し、第１の実施の形態で説明したような、低損失の電極構成を実施することによって達成することができる。また、外部回路との接続に用いる給電部１５は一カ所とすることもでき外部回路の負担を軽減することができる。この給電線１４ａ，１４ｂ，給電部１５の形状、配置をのぞく他の内容は、上記の第一の実施の形態と同様である。

【００６３】続いて、本実施の形態における、アンテナの回路基板への取付の一例について、説明する。

【００６４】まず、アース電極及び給電回路（送受信回路）に接続される所望のランドパターンを備え、ここに適当な量のクリームはんだが印刷／塗布された回路基板上に本発明のアンテナを実装し、リフロー処理して、回路基板にはんだ付けする。なお、この時、取付強度を向上させるために、有機接着材などをアンテナと回路基板との間に設けてもよい。また、回路基板を外部からの電波や輻射などによって影響されないように、鉄板、銅板、アルミ板等の導電性平板、フェライト板等の磁性平板、導電性平板と磁性平板の複合平板などを用いてボックス状に覆い、シールドすることが望ましい。

【００６５】次に、上述のアンテナを用いた応用例について説明する。

【００６６】図８は本発明のアンテナを用いた無線ＬＡＮ装置を示す図であり、図８において、２０，２１はそれぞれ無線ＬＡＮ装置、２２，２３はそれぞれ無線ＬＡＮ装置２０，２１にそれぞれ接続されたパーソナルコンピュータなどの電子機器、２４は無線ＬＡＮ装置２０内に設けられた受信手段、２５は無線ＬＡＮ装置２０内に設けられた送信手段、２６は無線ＬＡＮ装置２１内に設けられた受信手段、２７は無線ＬＡＮ装置２１内に設け

られた送信手段、２８，２９はそれぞれ無線ＬＡＮ装置２０，２１にそれぞれ設けられ、前述の図１から図７に示すアンテナを用いた。

【００６７】電子機器２２から電子機器２３に所定のデータを転送したい場合には、電子機器２２から送られてきたデータ信号を送信手段２５にて変調し、所定の送信信号に変換し、その送信信号をアンテナ２８から送信する。アンテナ２８から送信した送信信号は、アンテナ２９にて受信され、受信手段２６にて所定のデータ信号に復調され、そのデータ信号は電子機器２３に送られる。

【００６８】逆に電子機器２３から電子機器２２に所定のデータを転送したい場合には、電子機器２３から送られてきたデータ信号を送信手段２７にて変調し、所定の送信信号に変換し、その送信信号をアンテナ２９から送信する。アンテナ２９から送信した送信信号は、アンテナ２８にて受信され、受信手段２４にて所定のデータ信号に復調され、そのデータ信号は電子機器２２に送られる。

【００６９】以上の様に構成された無線ＬＡＮ装置２０，２１では、アンテナ２８，２９を非常に小型化することができ、しかも水平方向に対して送受信特性の指向性を大きくできるので、無線ＬＡＮ装置２０，２１の配置や、アンテナ２８，２９の配置場所等の限定が少なくなり、レイアウトが簡単になるとともに、データ通信を確実に行うことができる。

【００７０】なお、ここでは、無線ＬＡＮ装置を用いて説明したが、用途は、必ずしも上記の内容に限定されるものではなく、無線通信機器において、広く応用することができる。

【００７１】次に、図９を用いてアンテナ装置の実施の１形態について説明する。

【００７２】図９において、１６は上述の本発明になるアンテナ、１７ａ，１７ｂは本アンテナ装置を保護したり、防水など耐候性を確保するためのレドーム（カバー）、１８は、半導体、フィルタ、抵抗、コンデンサなどの電子部品が実装されたローノイズアンプ基板、１９ａはアンテナで受信した信号をローノイズアンプで増幅した後、信号処理回路へ伝達したり、ローノイズアンプへ電力を供給する同軸ケーブル、１９ｂは本アンテナ装置を信号処理回路や電源に電気的に接続するためのコネクタである。このような構成からなるアンテナ装置とすることによって、信号処理回路や電源から離れたアンテナ装置の送受信にもっとも適した場所に本アンテナ装置を容易に設置することができ、さまざまな応用用途に柔軟に適合させることができる。また、本発明になるアンテナやローノイズアンプを埃や衝撃などから保護し、風雨や高い湿度などからまもることができ、高信頼性を保持したアンテナ装置を提供することができる。

【００７３】

【発明の効果】本発明は、基板と、基板の一方の主面に対向して設けられた放射電極と、基板の他方の主面に対向して設けられたアース電極と、放射電極と電気的に接続され、しかも少なくとも一方の主面と基板の側面の双方に設けられるとともにアース電極とは非接触に設けられた給電手段を備え、給電手段がインダクタンス成分を有すると共に、給電手段と放射電極の間、給電手段とアース電極間それぞれにキャパシタンス成分を有する構成とした事によって、給電ピンがなく、自動実装可能で、かつ、製造が容易で、歩留りが高く、さらに特性調整が容易となる。

【図面の簡単な説明】

【図１】本発明の一実施の形態におけるアンテナを示す表面斜視図

【図２】本発明の一実施の形態におけるアンテナを示す裏面斜視図

【図３】本発明の一実施の形態におけるアンテナを示す給電手段側の側面図

【図４】本発明の一実施の形態におけるアンテナの放射電極を示す平面図

【図５】本発明の一実施の形態におけるアンテナのアース電極を示す平面図

【図６】本発明の他の実施の形態におけるアンテナの放射電極を示す平面図

【図７】本発明の他の実施の形態におけるアンテナを示す斜視図

【図８】本発明のアンテナを用いた無線ＬＡＮ装置を示す図

【図９】本発明のアンテナを用いたアンテナ装置を示す断面図

【符号の説明】

１　基板
２　放射電極
３，４　給電線
５　給電部
６　アース電極
７　固定用電極
８　給電線と放射電極間のスリット
９　縮帯分離素子（放射電極切り欠き部）
１０，１１，１２　周波数調整用スリット
１３　放射電極
１４ａ，１４ｂ　給電線
１５　給電部
１６　アンテナ
１７ａ，１７ｂ　レドーム
１８　ローノイズアンプ基板
１９ａ　同軸ケーブル
１９ｂ　コネクタ
２０，２１　無線ＬＡＮ装置
２２，２３　電子機器
２４，２６　受信手段

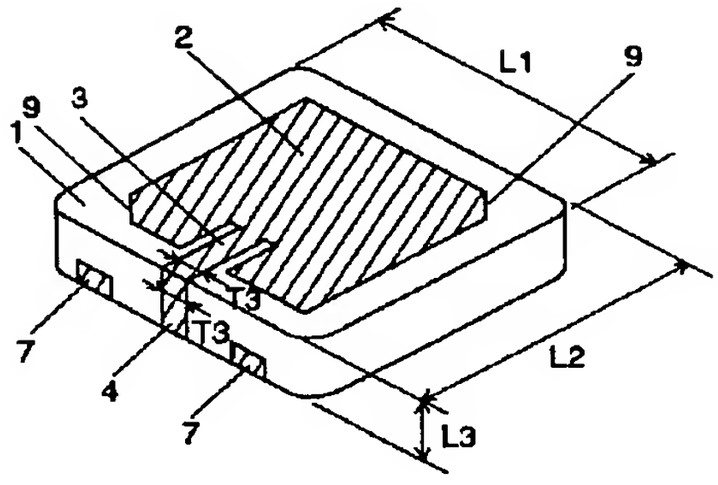
15

２５，２７　送信手段

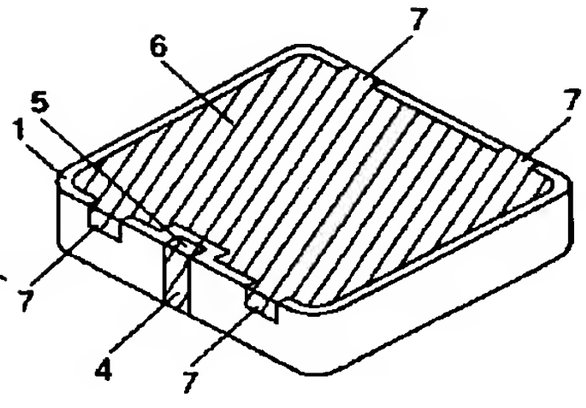
16

２８，２９　アンテナ

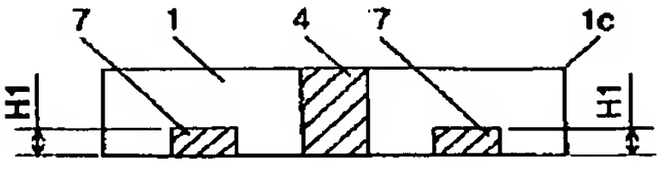
【図１】



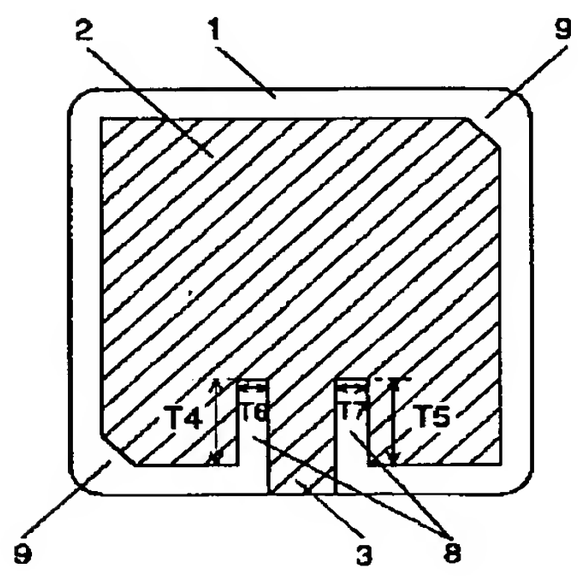
【図２】



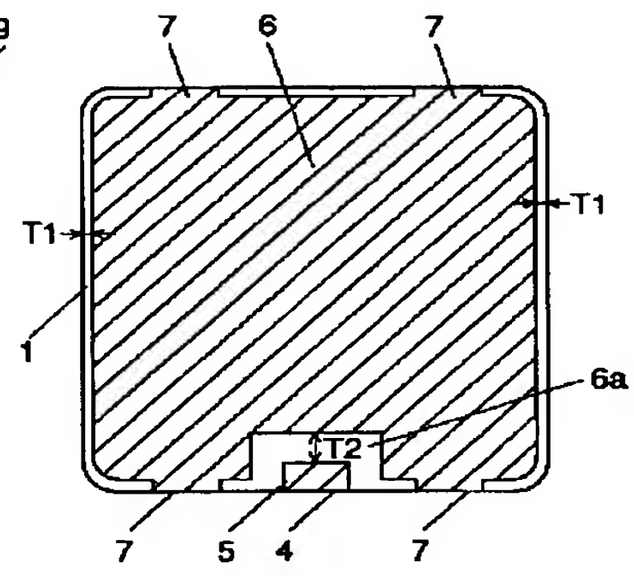
【図３】



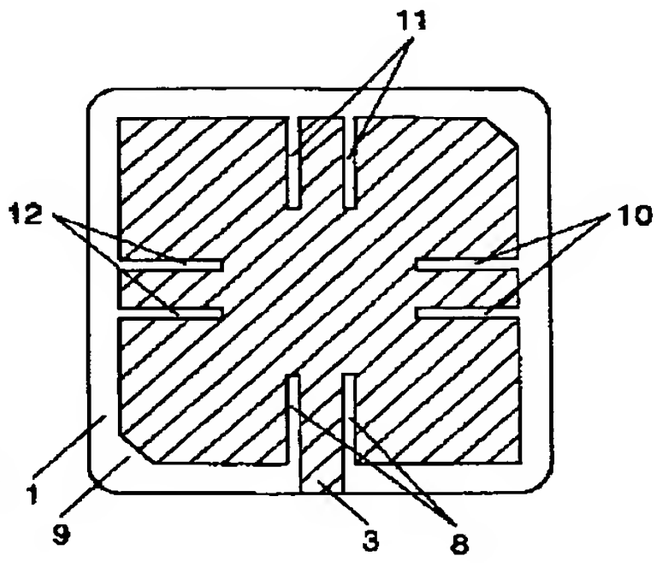
【図４】



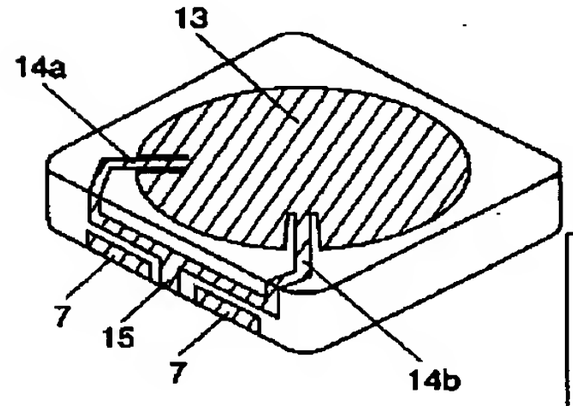
【図５】



【図６】



【図７】



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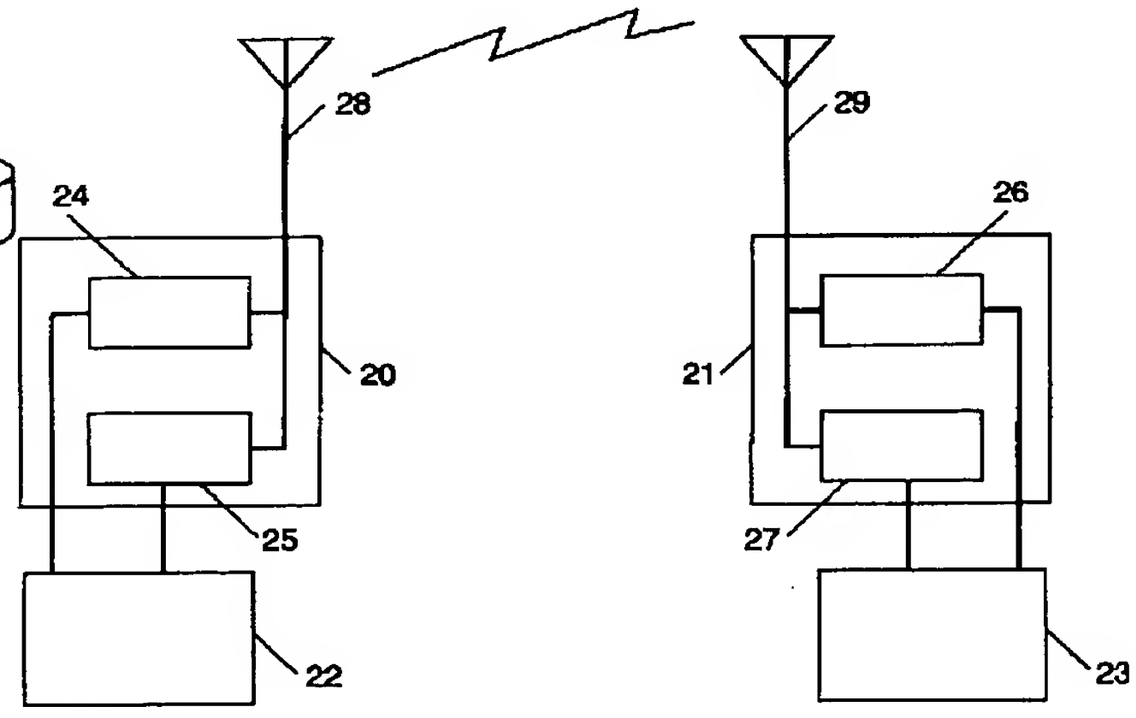
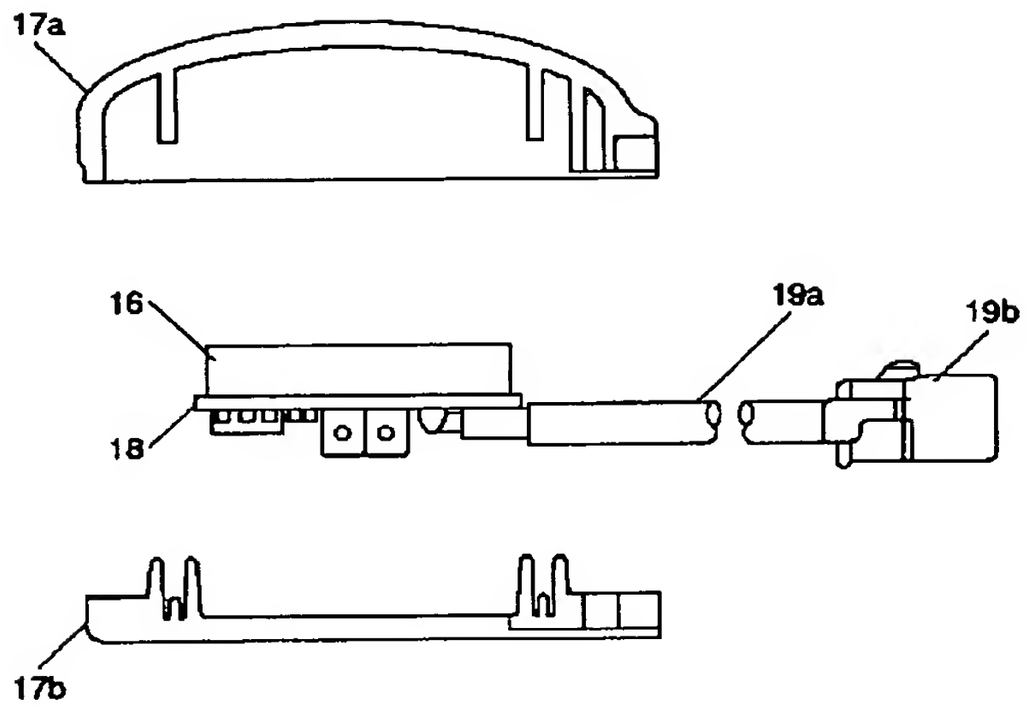


【図９】



フロントページの続き

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5J045 AA01 AA02 AA05 AB05 AB06 DA10 EA07 GA05 GA06 HA03 NA01